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STRATEGY RESEARCH PROJECT

ENHANCING PROGRAMMATIC ANALYSIS TOOLS FOR THE 21ST CENTURY DEFENSE TRANSPORTATION SYSTEM

BY

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Enhancing Programmatic Analysis Tools for the 21st Century Defense Transportation System

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ABSTRACT

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Since the early 1990s, the Army's overseas presence has been dramatically reduced and its reliance on the Defense Transportation System (DTS) to effectively and efficiently project power has correspondingly increased. As a result, a significant portion of the Army and the overall Department of Defense (DOD) budgets continues to be allocated to the military and commercial components of the DTS. However, neither the Army nor its partners in the joint transportation community are currently able to provide DOD's strategic leaders with the detailed benefit/cost data required to make the types of investment decisions common in the corporate world. This study presents three actions that would lead to the development and effective employment of a more comprehensive, holistic, and integrated set of cost-based deployment modeling tools—tools that could guide programmatic transportation decisions well into the 21st Century.

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Our ability to project power, both from the United States and from forward deployed locations, has strategic value beyond crisis response. It is a day in and day out contributor to deterrence, regional stability, and collective security. It becomes an even more critical part of our military strategy since overseas presence will be reduced and our regional focus has been enhanced.

--National Military Strategy 1992

BACKGROUND

Since the early 1990s, America's Army has dramatically decreased its forward presence. As of 30 September 1997, approximately 73 percent of total active Army manpower was assigned to bases in the Continental United States (CONUS).[1] Another 10 percent was based in Western Europe[2] and would have to be significantly re-positioned to engage in what the Department of Defense (DOD) officials believe to be the most likely future major contingencies.[3]

This basing shift has heightened the Army's reliance on efficient transportation to project power to its "place of business"[4] in a timely manner. Two of DOD's most widely recognized master planning documents, Joint Vision 2010 and Army Vision 2010, have cited efficient power projection and focused transportation-based logistics[5] as critical to successful U.S. military engagement and mission accomplishment.

While transportation and power projection are DOD-wide challenges often requiring close inter-service coordination, the Army has a pronounced, vested interest in the state of the Defense Transportation System (DTS). To respond to crises, the Army depends primarily upon supporting systems, both military and commercial, outside its immediate control. In fact, "defense planners believe that [in the future] Army forces will constitute about 77 percent of DOD's total inter-theater contingency lift requirement."[6]

> **The American people will continue to expect us to win in any engagement, but they will also expect us to be more efficient in protecting lives and resources while accomplishing the mission successfully.**
>
> -- Joint Vision 2010

THE CHALLENGE

Achieving and maintaining an efficient Army transportation and power projection capability consumes a significant portion of our nation's defense budget. For example, "between 1998 and 2002, the Administration proposed spending nearly $20 Billion [1997 dollars] to acquire new cargo planes and sealift ships. That amount constituted about seven percent of the military procurement spending over that period."[7] The financial significance of transportation-related investment recommendations

and decisions is further portrayed in Table 1, which lists procurement and operating cost estimates for some of the most costly (and often analyzed) programs—those known as the strategic mobility triad of intertheater airlift, sealift, and cargo pre-positioning. There are many more: The DTS is a complex and costly network of inter-related systems, military and commercial, domestic and foreign. It is comprised of physical infrastructure, lift assets, command, control, and communication systems, and business processes, all functioning within a strict regulatory framework.

The financial magnitude of DTS-related programs and the time between their initiation and implementation (often 10 to 15 years) mandate that long-term "programmatic" recommendations (from the end of the Future Years Defense Plan [FYDP] well into the next generation)[8] be well-conceived and thoroughly analyzed by all concerned. DOD must ensure it receives the greatest possible operational benefit from its transportation-related investments. To do this effectively, it must work closely with the other members of the joint transportation community,[9] the programming community, and industry to do more than merely assess the DTS's ability to meet the operational performance goals of these 2010 vision statements. In the current environment of shrinking resources, the Army and the joint transportation community must be able to:

- Identify and clearly articulate the operational benefits and resource costs of potential investments,

Table 1

Planning Costs for Selected Army-Related Strategic Mobility Triad Options

(Planning Factors Only-Does not include Uniformed Force Structure)

Option	Procurement	Operating
Airlift:		
C-17 (new construction)	$200M/aircraft[1]	$6,739/hr[2]
C-33 (new construction of non-developmental 747 variant)	$140M/aircraft[1]	N/A
C-5 (Enhancement of Existing Fleet)	$40-42M/aircraft[1]	$13,497/hr[2]
Civil Reserve Air Fleet (CRAF)	$1.5B in passenger and $270 M in cargo contracts/annum in exchange for commitment to CRAF program[3]	
Sealift:		
Large Medium Speed Ro/Ro Maintained in Surge Status	$314M/vessel[4]	$7.3M/vessel/annum[4]
Ready Reserve Fleet Conversion Existing RRF vessels	$25,000 /000 sq. ft.[5]	$260M/yr/91vessels[6]
Procure and modify foreign vessels	$32M/vessel[7]	N/A
Commercial Charter	N/A	$23,000/day[8]
Maritime Security Program	$2.1M/vessel (min. 80,000sq ft RoRo or 500 TEU's)[6]	See note 9
Prepositioned Stocks:		
Prepositioned Cargo Ashore	$70M/Bde in Qatar[10]	N/A
Army Prepositioned Afloat (LMSR)	$314M/vessel[4]	$14.2M/vessel/annum[4]

Key: M= Million, B= Billion

Notes:

1. Air Mobility Commands, AMC/XPR, 5 January 1999
2. USTRANSCOM J-3/4, November 1998
3. Congressional Budget Office Study, Moving U.S. Forces: Options for Strategic Mobility, February 1997, p.16
4. Ibid, p.26
5. Cost per foot for RRF conversion varies widely, depending on vessel and modifications required. Estimates derived by author based on projected modifications cost currently proposed by MarAd and USTRANSCOM in an undated briefing (1998) package prepared by USTRANSCOM, USTC J-5.
6. MarAd LNO to USTRANSCOM USTC J-5, dated 4 Jan 99
7. Moving U.S. Forces: Options for Strategic Mobility, p. 27
8. Ibid, p. 32. Cost per day based on Desert Shield/Storm daily usage rates: Does not necessarily include additional costs usually associated with long-term charter.
9. Maritime Security Program and VISA data provided by MarAd LNO to USTRANSCOM (USTC J-5). It should be noted that shipment costs for VISA carriers are negotiated at time of usage and are in addition to the MSP costs.
10. Moving U.S. Forces: Options for Strategic Mobility, p. 43

* Establish quantitatively-based funding priorities,

* Define how and when to best allocate resources during program execution.

> **We anticipate the need to be selective in the technologies we choose, and thus expect continuing assessment and adjustments for affordability as well as for the other lessons during the implementation process. . .We will have to make the hard choices to achieve tradeoffs that will bring the best balance, most capability and greatest interoperability for the least cost.**
>
> -- Joint Vision 2010

PRESENT CAPABILITY

To date, both the Army and joint transportation community as a whole have lacked the capability to perform resource-oriented programmatic analyses in a coordinated and comprehensive fashion. Consider, for example, three of the most significant mid-term (6-9 years into the future) programmatic assessments: <u>The Mobility Requirements Study</u> (1992 & 1993), <u>The Mobility Requirements Study Bottom-Up Review Update</u> (1995), and the transportation section of <u>The Report of the Quadrennial Defense Review</u> (1997). These are viewed as landmark analyses of the DTS, having provided the programmatic community with excellent assessments of the operational risk to which warfighters could be exposed because of cargo delivery limitations.

In these particular studies, DOD modelers ran scenario-specific force packages through an inter-theater deployment model using a variety of combinations involving each of the strategic mobility triad categories. Analysts then compared the time-phased "closure" of cargo and personnel at the ports of debarkation for each strategic mobility combination to the force arrival schedule that the study team had determined to be "required" to enable the supported commander to prosecute his mission with moderate or low risk.[10]

The results of the MRS series of analyses and the QDR were used to advocate and validate significant DOD investment in the procurement of DOD sealift (both surge and afloat pre-loaded, pre-positioned vessels), intertheater airlift, and CONUS infrastructure elements of the DTS. However, these studies suffered from three significant analytical deficiencies:

- Timely delivery of cargo and personnel was essentially the sole measure of DTS effectiveness.
- There was no structured method for determining the costs associated with a particular deployment alternative. Therefore, quantitative comparisons of modes of investment and procurement, common in the corporate world (e.g., purchase vs. lease vs. secure through a retainer/incentive contract, etc.), were not conducted.
- Not all components of the DTS were addressed.

As a result, the studies did not provide the joint transportation community with the data or information necessary to effectively perform the four functions stated previously. Therefore, they provided only partial answers to the programmatic community.

BUILDING A NEW TOOLKIT FOR TRANSPORTATION PROCUREMENT AND OPERATIONAL ANALYSES

The following analysis yields three broad actions that could help the transportation community better perform and utilize quantitative programmatic assessments. While not intended as a detailed recipe for creating the optimal "programmatic tool kit," this analysis does identify three major actions that should be taken in revamping and upgrading the current one:

- Integrate cost assessment tools directly into the deployment modeling "suite."
- Ensure that end users of the analytical data are active in the creation of the modeling suite, selection of operational and analytical parameters surrounding its usage, and interpretation of its output.
- Initiate a process to forecast the characteristics and algorithms of the future transportation environment, then perform long-term programmatic modeling of the DTS using these elements.

INTEGRATE COST ASSESSMENT TOOLS DIRECTLY INTO THE DEPLOYMENT MODELING "SUITE":

As a result of modeling limitations that persist to this day, the transportation community has been able to examine and recommend only a few options from a large pool of acquisition/investment strategies that could potentially meet the warfighter's major operational requirements of timely delivery, operational flexibility, rapid reconstitution, and minimal vulnerability. Further, those strategies that have been

recommended have been subjected to only the most aggregate benefit/cost-type analysis. It has therefore been impossible to quantitatively demonstrate that the Army and the DOD transportation community are getting the most capable support package for the money invested. These modeling shortfalls can be reduced by three actions:

1. Integrate dynamic, quantitative financial analysis mechanisms directly into the force projection modeling suite:

The deployment modeling process has matured significantly in the late 1990s. Not only have the individual models increased in accuracy and resolution, but the transportation community's ability to move data between and among the models has also improved. These modeling tools were independently conceived and developed by, or under the direction of, various members of the joint transportation community. Each had a specific focus and was designed to sub-optimize a particular process or activity within the DTS' origin-to-destination pipeline, not to optimize the entire pipeline.

The evolving Analysis of Mobility Platform (AMP) program, overseen by the U.S. Transportation Command (USTRANSCOM) in coordination with its components, is designed to serve as the vehicle for more holistic DTS assessments. The goal of the AMP effort is to create a common platform or framework that will facilitate the transfer of data between and among many of these previously independent activity or link models. This platform is being designed to produce a high fidelity (in most cases, down to

the individual item, or "Level 4" detail) simulation of forces moving from home installation to the tactical assembly area in the theater. Although not all the linkages have yet been developed, modelers from USTRANSCOM and its components are examining use of the current tools in a partially linked configuration during the on-going Mobility Requirements Study, 2005 (MRS '05).[11]

However, without further enhancement, even the AMP-based suite of models will continue to focus primarily on the "closure" times and lift utilization rates of a particular scenario, with little or no direct recognition of the resource implications associated with a particular transportation asset package or operational strategy. As a result, only unsophisticated and low-resolution benefit/cost comparisons will be available to support end users in their development of procurement and investment recommendations.

Resource cost modeling has also matured, but that evolution has been guided by the single developer and customer, or, at best, the budgetary community. The two most common approaches to cost modeling—activity-based and requirements-based analysis—currently do not reflect any direct relationship to the force flow plan developed by the transportation community. Activity-based analysis, for example, is generally performed after the Time-Phased Force Deployment Data (TPFDD) has been "flowed" through the deployment model.[12] The inputs are the

aggregated personnel quantities and/or cargo weights or volumes (either in short tons or measurement tons) outputs that the deployment model has identified as either passing through a node, or being moved along a link by a particular shipment mode during a selected time window.[13] USTRANSCOM is currently investigating how one such tool, the Transportation Analysis Costing Tool (TACT), if integrated into the AMP shell, could provide at least partial (Army forces only and at a low level of resolution) costing information to support deliberate (operations and concept plan-based) planning and review of potential courses of action.[14]

The requirements-based methodology consists of applying costing algorithms and planning factors for each major segment (link or node) of a deployment flow to a manually created force spreadsheet. The database of forces is not directly related to a TPFDD, but rather is built by the analyst using personnel and cargo figures from the notional Type Unit Characteristics (TUCHA) file for a list of generic units as described by Standard [Unit] Reference Codes (SRC).[15] Two particular models share this approach: The Contingency Operations Support Tool (COST) and The Army Force and Organization Cost Estimating System (FORCES). COST is currently being developed by the Institute for Defense Analysis under the sponsorship of the DOD Comptroller's Office.[16] FORCES is a multi-disciplinary cost estimating tool currently being used by the U.S. Army Cost and Economic Analysis Center.

Among the main customers for information from this modeling suite is the Army's Program Analysis and Evaluation Office.[17]

This method of estimating cost is often very time- and labor-intensive, particularly when applied to either a fine-grained or very large deploying force (of potentially hundreds of line entries.) Output quality is dependent upon the disaggregation of the forces in the database (resolution of the input data) and the correlation between the database personnel and cargo figures for that SRC and the figures for the actual units (accuracy of input data).

Another significant limitation inherent in any TPFDD-independent cost analysis is that, while the analyst is able to designate the preferred mode of shipment, that mode may not be the same one the deployment models have been forced to use, given lift availability and pipeline capacity at that point in the deployment.[18] While this could alter costs for any segment, it could dramatically change estimates for the intertheater (air vs. sea) leg. To meet the four programmatic objectives listed at the outset of this analysis, the joint transportation community must be prepared to relate operational benefits to resource implications for numerous DTS mid- and long-term procurement/investment strategies. This analysis must be performed rapidly, directly (in most cases using more specific data, as will be available through AMP), and iteratively. The

most rational approach appears to be the creation of links that will enable the two modeling suites to interact directly.

Successful interaction will require much more than mere re-programming of computer models. The transportation and financial communities must understand each other's data needs, analytic capabilities, and the type of information each is ultimately required to generate from the output data. Further, it is important that the community of end users come to some consensus regarding when use of such an analytical suite would and would not be appropriate.

Supporting databases must also be reviewed for construction, composition, and maintenance. Entirely new databases may be needed and current ones may require major redesign. Table 2 provides a small sample of the major databases that may need to be built or revamped and populated to support such analyses.

Finally, all potential end-users must specify their desires and baseline requirements for fidelity (output resolution and accuracy) and analytical responsiveness (model set-up and run time). The suite may ultimately be structured to produce a range of output resolutions—from a rough-order-of-magnitude estimate, required for more strategic level program review and trend analysis, to a more highly detailed set of results suitable for operational planning.

Table 2

Sample of Data Bases Required to Perform Deployment-related Cost Modeling

Broad Category	Subordinate Files
Infrastructure Networks	
Highway and Rail Links	Length, Dimensional/ Weight Restrictions, Commodity Restrictions, Flow Rate (Miles per Hr/Day), Carrying Capacity
Air and Sea Links	Length, Flow Rate (NM/Hr), Frequency of Route Usage
Facilities	
Origin OutloadSite/Destination	Throughput, Operational Restrictions, Force Structure Requirements, Supporting Force Requirements
Seaports (CONUS/OCONUS)	Draft, Vessel Types that can be Physically Accommodated, Staging Reception and Clearance Facilities, Throughput, Cargo Restrictions, Operating Hour Restrictions, Supporting Force Structure, Operating Fees
Airfields (CONUS/OCONUS)	Max. on Ground, Cargo Throughput, Cargo Restrictions, Supporting Force Structure, Operating Fees
Lift Assets	
Sea, Air, Rail, Highway	Unit Capacity (weight/dimensions), Cargo Restrictions, Speed, Supporting Force Structure
Cost Parameters	
Lift and Nodal Costs	Procurement cost/unit, Lease Cost, Operating Cost per Ton Mile or per Hr. by Mode, Transit Costs (e.g., Panama and Suez Canal, etc.), Activation Cost (e.g., RRF prep.), Port Operating Costs, Cargo Handling and Inland Transportation Costs, Contingency Program/ Retainer Costs, Incentive Costs, Compensation Rates per Soldier/ Civilian Employee, Exchange Rates

***2. The definition of "benefits" and "costs" should be reviewed and possibly expanded*:**

Once the end users determine output and functional requirements, both communities must adopt precise, workable definitions for the terms "benefits" and "costs." The MRS series and the QDR both considered DTS-related benefits and costs in a very narrow framework. Programmatic decisions and subsequent recommendations were based primarily on matching the potential closure levels produced by various strategic mobility "packages" against generalized asset procurement costs.

Future analytical tools should be capable of addressing the impact a proposed DTS strategy could have on all major operational factors important to the warfighter. For example, a significant, but previously "too-hard-to-measure," potential benefit is functional diversity. A DTS that affords the deploying force a wide variety of shipment routes and port options enhances both the supported and supporting commanders' operational flexibility and reduces the size of the potential target (footprint) at any particular node. This kind of flexibility becomes particularly significant when weapons of mass destruction are a potential threat. (However, the positive impacts of dispersion must be quickly and analytically weighed against their potentially negative impacts on force reconstitution and supporting force structure requirements.)

Further, the next generation modeling suite should address a wide range of procurement and operational resource implications,

not just procurement costs in dollars. A more complete analysis would include those collateral support structure line items (such as materiel handling and transfer equipment) associated with sustained operation of the DTS component, whether they belong to DOD or the commercial sector. Manpower should receive particular emphasis: In an environment of personnel constraints, this consideration may be as significant to the end user as pure dollar figures. The "life-cycle cost" approach currently used for weapons and automation systems could offer a framework for determining which factors to capture and how to measure them.

Creating a costing framework, while certainly not trivial, may not be as challenging as defining and limiting the "scope" of the terms. Benefits and costs often "bleed" into the diplomatic and economic arenas of national security. For example, power projection capability, when used as a Flexible Deterrent Option (FDO),[19] may send a strong signal of commitment to a potential adversary, precluding or at least forestalling the need for a major deployment. (Any delay in hostilities would also provide operators more time to mobilize both the military and commercial components of the DTS, thus reducing organic fleet requirements.) An example of an economic ripple would be a program's impact on the continued vitality of a critical element of the strategic industrial base, such as the U.S. shipbuilding industry. Consideration of each of these second- and third-order impacts during an analysis should be addressed case-by-case or run-by-

run, with extensive input from both the transportation and budgetary communities.

One final challenge in developing cost data is determining that portion of the subject investment that should be categorized as "contingency deployment enhancement." For example, many infrastructure and automation investments are not based solely on deployment efficiencies, but rather are driven by a need to enhance training and day-to-day operations.[20]

3. The community should review (and possibly expand) the field of DTS components it analyzes:

Rather than simply "re-looking" and making adjustments to only those elements of the transportation environment that are relatively easy to quantify (home station and embarkation port infrastructure and the strategic mobility triad), future automated assessments of the DTS must be more holistically formulated. Using the current deployment modeling tools as a baseline, transportation analysts must also be capable of performing similar benefit/cost-type assessments of major transportation-related technologies, information and communications systems, operational/business processes, and legal/regulatory restrictions.

DOD has developed and fielded many automation and information systems in an attempt to provide both operators and real-time execution planners with the high quality, real-time information they need to conduct their daily business. Their

procurement and fielding costs (in dollars) and operational benefits have historically been subject to a structured review by the Automation System Acquisition Review Committees as directed in Army Regulation 25-3, Army Life Cycle Management of Information Systems (November 1989).[21] However, neither the impact on DOD's ability to receive, process and push personnel and cargo through the pipeline (benefit) nor the associated incremental resource cost has been adequately quantified in a power projection model. For example, it is not currently possible to quantify the deployment benefit (in terms of closure rates) DOD can expect to realize with the joint community's evolving baseline suite of automated transportation and movement control tools, the Transportation Coordinator's Automated Information Management System of TC-AIMS-II.[22]

Business processes that deal with DOD's commercial transportation partners have also been neglected in existing models. For example, it may be possible that modifying the current processes by which DOD's commercial air and sea partners provide militarily useful lift assets could favorably shift industry's lift availability profiles.[23] The basic programs already exist—the Civil Reserve Air Fleet (CRAF) program for airframes and the Voluntary Intermodal Sealift Agreement (VISA) program for sealift assets. In return for an increase in its annual contingency retainer and/or incentives programs, DOD may be able to realize a dramatic reduction in its organic strategic

lift requirements. However, the detailed deployment-based cost data that DOD needs to effectively negotiate such an adjustment with industry is not currently available.

The relational benefits and costs associated with DOD's business processes (as laid out in Army and joint policy and doctrine) and those federal/state shipping policies and regulations impacting defense transportation are also neglected. Simply put, the next generation of deployment models should be designed to capture the benefits and costs for all major components of the DTS.

ENSURE THAT END USERS OF THE ANALYTICAL DATA ARE ACTIVE IN THE CREATION OF THE MODELING SUITE, SELECTION OF THE OPERATIONAL AND ANALYTICAL PARAMETERS SURROUNDING ITS USAGE, AND INTERPRETATION OF ITS OUTPUT:

A primary goal of conducting programmatic analysis is to ensure that operationally and financially sound programs are effectively advocated during the development of DOD's major budgetary guidance to the services, the Defense Program Guidance (DPG). For transportation-related programs and issues to be rationally discussed during those steps leading up to the development of the DPG, all involved (transporters and non-transporters, alike) must have ready access to understandable information presented in a familiar format. The transportation community must ensure it has a solid understanding the strategic-level financial and operational goals and ground rules.

Transporters must appreciate the context of the questions and be prepared to answer them appropriately. Finally, they must speak with a single voice (rather than from a perspective of service parochialism). Three actions can help the transportation community provide this type input:

- Ensure senior-level oversight by both the transportation and budgetary communities during model development.
- Influence the development and application of study parameters, clearly articulating the ground rules and "framing" the questions.
- Develop a well-established method for interpreting and disseminating the analytical results to those working in planning, programming, and budgeting.

1. Ensure senior-level oversight by both transportation and budgetary communities during model development:

Senior members of both the budgetary and transportation communities should provide active oversight during the creation, development, and programmatic usage of the cost-based deployment modeling tools already addressed. Such joint oversight does not currently exist.

While many transportation-related costing tools are being developed to support a wide variety of end-users, not all development teams have the appropriate representation from the transportation community. Key transportation stakeholders who depend on deployment modeling results to provide programmatic input are often not even aware that these models exist or are

under development. These stakeholders include both the flag-level and staff officers of the Joint Staff, J-4 (Directorate of Logistics) and Army staff working strategic mobility issues as part of the Joint Warfighting Capability Assessment (JWCA/JROC) process as well as those on the Commander in Chiefs' (CINC's) staff (to include those at USTRANSCOM) charged with developing Integrated Priority Lists and related activities.[24]

Independently designed and managed tools are likely to be "stovepiped," providing output that supports only a selected set of end users. Deployment-related cost modeling appears in danger of following the same path that deployment modeling took until a few years ago. The result is likely to be expensive operational redundancy, output data that is not in a format usable in other models, and results that are confusing or contradictory.

In the last five years, USTRANSCOM has taken significant steps to resolve these potentially wasteful (and confusing) "disconnects" in the deployment modeling area through the Transportation Analysis Models and Simulation (TAMS) review process.[25] Under the direction of its Joint Transportation CIM (Corporate Information Management) Center (JTCC), a wide variety of potential end users within the transportation community participated in an intensive survey process to identify their output requirements. Once these requirements were defined, the JTCC, with input from both the users and developers, reviewed the

wide field of functioning and evolving models. The result has been the selection of a smaller set of "migrations systems" that can currently meet, or will meet with additional developmental funding, the designated requirements. The success of this program is largely attributable to the involvement of flag level officers from the planning and operations directorates both at USTRANSCOM and the modeling and analytical cells from its component commands.

A parallel JTCC effort which has proven helpful in designing the next generation of models is the "As Is and To Be" process, in which end users and developers meet to determine future modeling performance requirements and chart a course to attain them. These two processes will reduce redundancy, ensure greater interoperability between and among models, and minimize data gaps. Together, they offer a potential framework for joint (transportation and budgetary) creation, development, and use of future cost-based deployment assessment tools.

2. Influence the development and application of the study parameters, clearly articulating the ground-rules and "framing the questions:

Better models are only part of the solution: Changes must be made in the analysis process. Despite the fact that the terms "transportation" and "mobility" appear prominently in the title or section headings of these assessments, transporters have traditionally assumed a reactive stance; they have essentially responded to the direction of the warfighter. As a result, team

members with limited operational transportation backgrounds have been responsible for developing study parameters, assumptions, and potential investment alternatives. Even the bottom line questions regarding capability of the DTS and the choice of tools used to determine that capability have been largely influenced by non-transporters. When transportation "working groups" do convene, they work very hard to answer questions that may not get to the real issues impacting deployability and strategic mobility.

Before any cost-related deployment modeling is initiated in the future, the transportation customer community (those who will base their subsequent programmatic efforts on the results of the output data) should collectively and proactively identify their programmatic goals. Once this list is drafted, it should be coordinated with the warfighting customers, the budgetary community, and senior level planners from the commercial transportation industry (most of whom already possess an adequate level of security clearance to discuss such matters). This process will ensure that appropriate questions are asked and that the quantitative responses are framed in the proper context and format. It will also ensure that the end users and modelers are comfortable that the selected analytical tools will produce a credible result.

3.* Develop a well-established method for interpreting and disseminating the analytical results to those working in planning, programming, and budgeting*:

Finally, the transportation community must remain engaged throughout the execution and interpretation phases of these assessments, offering constructive input as necessary. The publication of these analyses should not be viewed as an end state. Rather, they should be seen as merely baselines for numerous follow-on studies and catalysts to get the community to update its databases, situational scenarios, and assumptions—as well as models for more focused analytical efforts.[26]

Study results must be widely disseminated to those staff officers charged with the identification and direction of either future analyses or investment program reviews (such as JWCA) in a format that facilitates comparison of alternative programmatic proposals. Those working the issues of procurement, business processes, policy, force structure, and system design and testing must all be conversant regarding the DTS vulnerabilities and shortfalls identified during these assessments. Further, they must be able to cite these challenges and quantitatively articulate associated incremental benefits and costs as their programs or projects compete for programmatic recognition and resources.

INITIATE A PROCESS TO FORECAST THE CHARACTERISTICS AND ALGORITHMS OF THE FUTURE TRANSPORTATION ENVIRONMENT, THEN PERFORM LONG-TERM PROGRAMMATIC MODELING OF THE DTS USING THESE ELEMENTS:

The transportation community should start now to develop a sound and judicious process to describe, analyze, and program for the DTS of the next generation (2010 -2025). The QDR stipulates that the U.S. defense strategy for the near and long term must "prepare now for the threats and dangers of tomorrow and beyond."[27]

The "Army After Next" (AAN) program provides such a framework for peering into the next generation and predicting the environment in which the Army warfighter of the next generation must be prepared to operate. "[Through extensive analysis, to include deployment modeling] it is identifying new concepts of land warfare that have radical implications for the Army's organization, structure, operations and support."[28] Transporters must be major players in this futuristic effort: Not only will the warfighters' operational support requirements change, but also the DTS environment within which transporters must provide this support will change. Preparing to deal with this anticipated change will require forward, even "outside-the-box" thinking and the help of both industry and academia.

The dynamics of modern transportation-based logistics ("just enough-just in time") have given rise to a new and more efficient DTS. Transportation is continuously becoming more global, while and infrastructure and stock inventories are being trimmed.

International alliances have given rise to new trade routes, shared asset pools and facilities, and shared information. Equipment is being designed to be more cost efficient and business processes will continue to become more streamlined.

The inefficiencies inherent in moving DOD cargo will be harder for industry to support. For example, highly efficient, rapid turn-over seaports designed to support tomorrow's high volume "mega" containerships may no longer be willing or capable of devoting a portion of the port to roll-on/roll-off cargo.[29] Similar situations may arise with the advent of the next generation of cargo aircraft. This in turn will change how DOD loads and routes its cargo.[30]

Domestic and foreign infrastructure elements are continuously being enhanced (either through corporate or governmental investment) to take advantage of these trends. For example, it is unlikely Korea's surface infrastructure will look the same in 2025 as it does today. The information age will revolutionize how cargo and personnel are tracked and processed as they pass through the pipeline. Finally, international and domestic regulatory changes will further transform the landscape.

Deployment modelers must be able to do more than simply flow 21st Century forces over the 1999 network, using today's asset files and process algorithms. They must plot new modal networks/routes, integrate new pools of lift equipment, adjust throughput and pipeline capacities, and create efficiency and

costing algorithms that reflect new operational and business processes.

Collection of all the data elements necessary to populate and maintain the myriad of databases is likely to be very manpower-intensive. The massive data interpretation, trend analysis, and future-year data extrapolation efforts are likely to drive the community toward advanced analytical techniques and emerging technologies such as artificial intelligence (e.g., expert systems, neural networks, fuzzy logic, etc.)[31]

Such an effort will require input from multiple agents: USTRANSCOM and its components, the CINCs' staffs, and members of the intelligence community. It will also require strong links to non-traditional partners such as the Army's doctrinal community (particularly the battle labs), academia, industry groups, a new family of futuristic consultants, research organizations such as the Defense Advanced Research Projects Agency (DARPA), and governmental planning authorities.

In 1996, the Chairman of the Joint Chief of Staff's Deployment Special Action Group (DPSAG) directed that a similar effort be initiated to populate and maintain the current databases. A working group co-chaired by the Deployability Division of the Joint Staff, J-4 and USTRANSCOM has been genuinely challenged to reach consensus on a lead agent, functional administration, and collection responsibilities. The selection of required data elements and establishment of

catalog/cross-referencing formats, collection techniques, terms, units of measure, and currency standards will be even more daunting. (Once these issues are resolved, much of the actual "legwork" is likely to be turned over to a supporting contractor.)

Managerial oversight will be critical to ensure program coordination, the establishment of performance standards, and adequate resourcing. USTRANSCOM is certainly a logical candidate to lead this effort. U.S. Atlantic Command, in its role as the executive agent for joint experimentation, should also be a major contributor.

Although projecting the future is an order of magnitude more difficult than describing the present environment, the effort will pay dividends. Armed with sound predictions regarding the future DTS and a library of databases that will enable proactive benefit/cost assessments, the transportation community will be able to programmatically chart the course of power projection well into the next generation.

SUMMARY AND RECOMMENDATIONS

The current tools and processes used to determine, interpret, and articulate Army force projection benefit/cost relationships for the DTS are simply inadequate. They do not provide the programmatic community with sufficient information necessary to make those investment decisions common in the

corporate world. Deployment-related cost estimation is essentially antiseptic and static: It revolves around generic (notional) units and ignores the dynamics of time-phased lift and/or pipeline capacity. Pure deployment modeling focuses solely on the timeliness of personnel and cargo arrival, ignoring many of the other operational attributes critical to the warfighter's successful employment of his force. Both forms of analysis are largely stovepiped and myopic, designed to support only a limited community of end-users. To ensure DOD gets the best operational return on its investment, these stand-alone tools must transition toward, and ultimately be replaced by, a more holistic, dynamic and integrated suite. This transition could be either a part of the maturation of AMP or occur concomitantly with the development of the next generation of programmatic modeling tools, such as the Joint Warfare System or JWARS.[32]

The selection of the suite's component models should be based on a process similar to TAMS. The design and culturing of the suite should be guided by a blueprint crafted during "As Is and To Be" sessions. USTRANSCOM's JTCC has proven highly capable of administering these two processes: This appears to be a logical next task.

This controlled evolution should be a two-dimensional effort. Horizontally, it will require active multi-disciplinary (transportation and budgetary) staff officer participation. The

transportation community's representatives should include, as a minimum, USTRANSCOM's J-3/4, J-5, and J-8 staff sections, its component commands, and key logisticians on the Army and joint staffs. Programming representatives should come from the Office of the Army Comptroller, the Secretary of Defense's Office for Program Evaluation and Analysis (OSD PA&E), and the Office of the Joint Chiefs of Staff, J-8.

Vertically, flag level officers representing both the analytic and programmatic communities must also be actively involved in defining performance goals, in establishing functional priorities (this will undoubtedly be a multi-year, multi-phased effort), and in providing program oversight to the myriad of action officers.

More capable and integrated models by themselves should not be viewed as the panacea. The transportation community must be more proactive in defining those issues, scenarios, operational parameters, and measures of cost-efficiency and operational effectiveness relevant to their discipline.

Under USTRANSCOM's lead, transporters from all participating agencies should work with members of the warfighting community and industry representatives to frame and focus the strategic level questions associated with these analyses and properly frame the answers. A significant amount of deliberation should focus on the selection and application of models: Which questions can

and cannot be analytically assessed? Which tools will provide the most credible answer?

Results emerging from these analyses should be widely disseminated throughout the planning and programming communities. This sharing of information will ensure that near-term and mid-range programming strategies do not stifle DOD's efforts to prepare now for the next generation.

Finally, USTRANSCOM should undertake the task of initiating and advancing a multi-agency program to collect, interpret, and forecast those data elements that will best characterize the future DTS. This information, once integrated into a parallel set of networks, algorithms, databases, and models would enable DOD's strategic leaders to analytically assess the DTS of tomorrow and chart an operationally and fiscally sound course for transporting the Army After Next.

Word Count:5,699 w/o tables
6,171 w/ tables

ENDNOTES

[1] Office of Secretary of Defense, Directorate of Information Operations and Reports, Department of Defense Selected Manpower Statistics Fiscal Year 1997. Washington, D.C.: U.S. Government Printing Office, 1997, Figures tallied from data on pages 30-32.

[2] Ibid.

[3] These include the Southwest Asian and Northeast Asian regions DOD analysts currently use for analyzing Two Major Theater War (2-MTW) scenarios.

[4] The Military Traffic Management Command made "Getting Combat Power to its Place of Business" a recognized phrase within the transportation community in the late 1980's.

[5] The terms power Projection and transportation-based logistics have appeared in numerous master planning documents and briefings spawned by Joint Vision 2010, Army Vision 2010 and the Army's Revolution in Military Affairs briefing.

[6] Congressional Budget Office, Moving U.S. Forces: Options for Strategic Mobility (Washington,D.C. U.S. Government Printing Office, February 1997),xii.

[7] Ibid, xi.

[8] Most programmatic deployment analyses assess the environment out to the end of the FYDP. This is largely because of decreasing data fidelity after that point. Nearer-term (here and now) assessments are not discussed in this analysis due to their sensitivity to numerous other factors in the strategic environment and the impracticality of performing time- and labor-intensive analyses on near-term strategies.

[9] Due to the dependence upon the commercial sector and its sister services for highway, rail, airlift and sealift, Army power projection is a team effort.

[10] The definition of operational risk levels is often considered sensitive or classified information and is generally agreed upon during the early stages of an analysis.

[11] Michael Williams, Chief, Deployability Engineering Division, Military Traffic Management Command Transportation Engineering Agency, interview by author, 28 December 1998, Newport News,VA.

[12] The Time-Phased Force Deployment Data provides detailed cargo descriptions, origins, mode of shipment, (generally) destinations, and a detailed deployment itinerary for every unit in the database.

[13] Jay Marcotte, GRC Corporation, under contract to USTRANSCOM, J-5, Telephone interview by author, 6 January 1999.

[14] Ibid.

[15] Ibid.

[16] Paul Goree, Institute for Defense Analysis, Personal interview by author, 1 February 1999, Alexandria, VA.

[17] Judy Matthews, U.S. Army Cost and Economic Analysis Center, Personal interview by author, 1 February, 1999, Falls Church, VA.

[18] John Eggers, Senior Cost Analyst, Management Analysis Incorporated, Personal interview by author, 1 February, 1999, Vienna, VA.

[19] While a demonstration of heightened force projection posture may not be a standalone FDO, transportation and force projection are often an enabling component of many of the FDO's available.

[20] COL R.D. Clemece, Chief, Warfighting Analysis Division, Office of the Joint Chiefs of Staff, J-8, Telephone by author, 16 February, 1999.

[21] Elaine Dow-Hines, Funding Coordinator, Systems Integration Division, Military Traffic Management Command Transportation Engineering Agency, Telephone interview by author, 21 January 1999.

[22] COL Ralph Bush, Chief, Strategic Mobility Division, Transportation, Energy and Troop Support, Office of the Army Deputy Chief of Staff for Logistics, Personal interview by author, 1 February, 1999, Pentagon, Washington, D.C.

[23] Randy Heim (COL Ret.), Defense Advanced Research Projects Agency, Telephone interview by author, 3 December 1998.

[24] Karyl Paradise, Infrastructure Team, Mobility Analysis Division USTRANSCOM J-5, Telephone interview by author, 27 January 1999.

[25]Fabian Hobbs, USTRANSCOM J-3/4 (former staff officer with Joint Transportation Corporate Information Management (CIM)Center, USTRANSCOM), Telephone by author, 20 Jan 1999.

[26] Robert Drash, GRC Corporation, under contract to Office of the Secretary of Defense office of Program Analysis and Evaluation, Personal interview by author, 26 January, 1999, the Pentagon, Washington, D.C.

[27] U.S. Department of Defense, The Report of the Quadrennial Defense Review(Washington D.C.: U.S. Government Printing Office, May 1997),iv.

[28] Ibid,42.

[29] "Megaships" is the term often used to describe the latest generation of container vessels (greater than 6000 Twenty-foot equivalent units or TEU's). To be financially viable, these extremely large vessels will require spacious, deep-water ports with specialized (high-efficiency cargo processing, loading, and discharge) systems.

[30] A commercial air or sea port that makes a capital investment commitment to supporting these new lift assets may no longer be financially capable of devoting a portion of their real estate or systems to low-turn over, low-return DOD business. This may force DOD to identify and coordinate new origin/destination pairs for use during a contingency.

[31] Artificial Intelligence is a rapidly evolving field and any detailed discussion of its sub-disciplines or their potential applications to transportation analysis are beyond the scope of this paper.

[32] JWARS is an OSD PA&E-sponsored effort with multi-disciplinary participation. The "mobility" component of this integrated suite could provide a potential platform from which to conduct the suggested cost-based deployment modeling.

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